

REMARKS

Claims 3, 6, 7 and 10 are pending in this application. By this Amendment, claims 1, 2, 4, 5, 8 and 9 are cancelled without prejudice to or disclaimer of the subject matter contained therein, and claims 3, 6, 7 and 10 are amended. Claims 3, 6 and 7 are rewritten into independent form. Claim 10 is amended to correct antecedence. No new matter is added by any of these amendments.

Applicants gratefully acknowledge that claim 3 contains allowable subject matter. As such, Applicants rewrite claim 3 into independent form to recite the features of claim 1 and intervening claim 2. However, Applicants assert that claims 6, 7 and 10 are also allowable for the reasons discussed below.

Reconsideration based on the following remarks is respectfully requested.

I. The Claims Satisfy All Formal Requirements

The Office Action objects to claims 8 and 10 based on informalities. Claim 8 is cancelled, and claim 10 is amended to obviate the objection. Withdrawal of the claim objection is respectfully requested.

II. Claim 10 Satisfies the Requirements under 35 U.S.C. §112

The Office Action rejects claim 10 under 35 U.S.C. §112 as being indefinite. Claim 10 has been amended to obviate this rejection in view of the Examiner's helpful comments. Applicants assert that the guide protrusion described in the specification and shown in Fig. 10 represents an exemplary embodiment of a guide groove. Withdrawal of the rejection under 35 U.S.C. §112, second paragraph is respectfully requested.

III. Claims 6, 7 and 10 Define Patentable Subject Matter

The Office Action rejects claims 1 and 9 under 35 U.S.C. §102(b) over U.S. Patent 6,089,473 to Kein; claims 1, 2 and 4-8 under 35 U.S.C. §102(b) over U.S. Patent 6,170,763 to Fuchs *et al.* ("Fuchs"); claim 10 under 35 U.S.C. §102(b) over U.S. Patent 5,979,802 to

Hasegawa; and claim 10 under 35 U.S.C. §102(b) over U.S. Patent 5,984,211 to Sugimoto *et al.* ("Sugimoto"). These rejections are rendered moot with respect to claims 1, 2, 4, 5, 8 and 9, and are respectfully traversed with respect to the remaining claims.

Fuchs does not teach or suggest a fuel injection valve in which a nozzle hole is formed on a metering plate and fuel flowing on a face on the upstream side of the metering plate is injected outside of a face on the downstream side of the metering plate, the fuel injection valve comprising a vortex flow generator means for making a flow of fuel passing in the nozzle hole form into a vortex flow, wherein the vortex flow generator means is provided on the upstream side of the metering plate, wherein the vortex flow generator means is a vortex flow generator groove provided on a face on the upstream side of the metering plate so that the vortex flow generator groove can be connected to a wall face of the inlet of the nozzle hole, a main stream of fuel flowing in the groove is directed to a position deviating from a center of the nozzle hole, and a depth of the vortex flow generator groove is formed to be increased or decreased toward the nozzle hole, as recited in claim 6.

Moreover, Fuchs fails to teach or suggest a fuel injection valve in which a nozzle hole is formed on a metering plate and fuel flowing on a face on the upstream side of the metering plate is injected outside of a face on the downstream side of the metering plate, the fuel injection valve comprising: a vortex flow generator means for making a flow of fuel passing in the nozzle hole form into a vortex flow, wherein the vortex flow generator means is provided on the upstream side of the metering plate, wherein the vortex flow generator means is a vortex flow generator groove provided on a face on the upstream side of the metering plate so that the vortex flow generator groove can be connected to a wall face of the inlet of the nozzle hole, a main stream of fuel flowing in the groove is directed to a position deviating from a center of the nozzle hole, and the shape of the vortex flow generator groove is a rectangle, a semi-ellipse, a triangle having one vertex on the nozzle hole side, a triangle

having one vertex on the end portion side or a comma-shape curved in the direction of revolution of fuel, as recited in claim 7.

Instead, Fuchs discloses a fuel injection valve with an orifice plate. In particular, Fuchs teaches a valve support 1 with a longitudinal opening 3 concentric to an axis 2 with a valve needle 5 that can be joined to a spherical valve-closure member 7 within a valve-seat member 16. An orifice plate support 21 is disposed opposite the valve-closure member 7 of the valve-seat member 16, the support 21 including a feed-through opening 20 that is covered by an orifice plate 23 (col. 3, lines 21-54 and Fig. 1 of Fuchs). Applicants assert that Fuchs lacks a vortex flow generator groove that increases or decreases toward a nozzle hole, as recited in claim 6. Applicants further assert that Fuchs fails to teach or suggest a vortex flow generator groove that forms one of a rectangle, a semi-ellipse, a triangle having one vertex on the nozzle hole side, a triangle having one vertex on the end portion side and a comma-shape curve, as provided in claim 7.

Neither Hasegawa or Sugimoto teaches or suggests a fuel injection valve in which a nozzle hole is formed on a metering plate, fuel flowing on a face on the upstream side of the metering plate is injected outside of a face on the downstream side of the metering plate and a needle having a forward end face opposed to the metering plate is arranged on the upstream side of the metering plate, the fuel injection valve comprising a vortex flow generator means for making a flow of fuel passing in the nozzle hole form into a vortex flow, wherein the vortex flow generator means are a guide groove formed on the forward end face of the needle, as recited in claim 10.

Instead, Hasegawa discloses a fuel injection needle valve 4 inserted into a nozzle body 3 connected to a holder proper 1. In particular, Hasegawa teaches a rotary valve 7 coupled to a coupling shaft 10 towards the lower end of the needle valve 4, the coupling shaft having a groove 80 parallel to the axis. The nozzle body 3 includes nozzle holes 35 that align with

fuel passages 73 when the rotary valve 7 is rotated to so coincide (col. 5, lines 6-10, col. 6, lines 35-40, col. 8, lines 56-61 and Figs. 2 and 3A of Hasegawa). The passages 72 and nozzle holes 35 in Hasegawa project in axial and radial directions, precluding use for vortex flow generation, as recited in claim 10. Thus, Hasegawa cannot be properly applied to reject the claims under §102.

Further, Sugimoto discloses a fuel injection valve seat portion 1 with fuel flow passages 2. In particular, Sugimoto teaches a valve body 7 sliding within the valve seat portion 1 along glide portions 3. Sugimoto also teaches a plate 5 with orifices 6 at the end of the valve seat portion 1 (col. 5, lines 9-35 and Figs. 1-3 of Sugimoto). However, the orifices disclosed by Sugimoto are directed axially, thereby negating any ability to generate vortex flow, as recited in claim 10. Consequently, Sugimoto represents an improperly applied reference for rejection under §102.

A claim must be literally disclosed for a proper rejection under §102. This requirement is satisfied “only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference” (MPEP §2131). Applicants assert that the Office Action fails to satisfy this requirement with Fuchs, Hasegawa or Sugimoto.

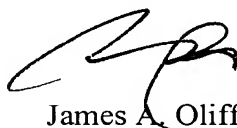
For at least these reasons, Applicants respectfully assert that the independent claims are patentable over the applied references. Consequently, all the claims are in condition for allowance. Thus, Applicants respectfully request that the rejections under 35 U.S.C. §102 be withdrawn.

IV. Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable reconsideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further is desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below.

Respectfully submitted,



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Attachment:
Amendment Transmittal

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